Bio-Hydrogen Refueling Station

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ABSTRACT

Hydrogen fuel cell cars are now available for lease and for sale. Renewable hydrogen fuel can be produced from water via electrolysis, or from biomass via gasification. Electrolysis is power-hungry with high demand from solar or wind power. Gasification, however, can be energy self-sufficient using a recently-patented thermochemical conversion technology known as Indirectly-Heated Pyrolytic Gasification. I-HPG produces a tar-free syngas from non-food woody biomass. This means the balance of plant can be small, so the overall system is economical at modest sizes. This makes it possible to produce renewable hydrogen from local agricultural residues; sufficient to create distributed refueling stations wherever there is feedstock. This work describes the specifics of a novel bio-hydrogen refueling station whereby the syngas produced has much of the hydrogen extracted with the remainder powering a generator to provide the electric power to the I-HPG system. Thus the system runs continuously. When paired with another new technology, moderate-pressure storage of hydrogen in porous silicon, there is the potential to also power the refueling operation. Such systems can be operated independently. It is even possible to design an energy self-sufficient farm where all electric power, heat, and hydrogen fuel is produced from the non-food residues of agricultural operations. No water is required, and the carbon footprint is negative, or at least neutral.